

# **PEPEROMIA WHEELERI**

## **RECOVERY PLAN**

PEPEROMIA WHEELERI RECOVERY PLAN

prepared by

U.S. Department of the Interior  
Fish and Wildlife Service  
Southeast Region  
Atlanta, Georgia

Approved:

  
Regional Director, U.S. Fish and Wildlife Service

Date:

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Recovery plans delineate reasonable actions which are believed to be required to recovery and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citations should read as follows:

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## EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR PEPEROMIA WHEELERI

Current Status: This species is listed as endangered. This endemic species is only known from the Monte Resaca area of the small island of Culebra (3,116 hectares) 27 kilometers to the east of Puerto Rico. The Monte Resaca area is included within the Culebra National Wildlife Refuge.

Habitat Requirements and Limiting Factors: Peperomia wheeleri, a herbaceous plant, occurs on large granodiorite boulders beneath the semi-evergreen seasonal forest of the Monte Resaca area of Culebra Island. Deforestation and grazing have restricted this species to its present location. Within this remaining forested area foraging by domestic fowl continue to threaten the species.

Recovery Objective: Delisting

Recovery Criteria: To protect existing populations and their habitats and establish new populations at other appropriate sites on Culebra.

### Actions Needed:

1. Monitor existing populations.
2. Exclude domestic fowl and cattle that alter the microhabitat of the species.
3. Conduct research on the life history of the species, and evaluate methods of propagation, and look for introduction sites.
4. Propagate and produce seedlings for enhancement of existing populations and the establishment of new populations on Culebra.

Total Estimated Cost of Recovery: Recovery costs for Peperomia wheeleri have been estimated at \$42,000 for the first three years. Subsequent expenditures will depend on the results of these preliminary studies and therefore cannot be estimated at this time.

Date of Recovery: Delisting should be initiated in 2025, if recovery criteria are met.

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## PART I. INTRODUCTION

Peperomia wheeleri is an evergreen, fleshy herb endemic to Culebra, a small island approximately 7,700 acres (3,116 hectares) in size, located only 17 miles (27 kilometers) to the east of Puerto Rico. Apparently never a widely distributed species, it is now restricted to the large granodiorite boulders of Monte Resaca and Flamenco on this island. Because of its growth form, the number of remaining individuals of Peperomia wheeleri is difficult to estimate. The majority are located within the 375 acre (152 hectares) Monte Resaca Unit of the Culebra National Wildlife Refuge. Deforestation and grazing, both of which have substantially altered the vegetation on Culebra, have restricted Peperomia wheeleri to its present location. Within the remaining forested area, foraging by domestic fowl and grazing continue to threaten the species' necessary microhabitat.

Peperomia wheeleri was determined to be an endangered species on January 14, 1987, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1987). Critical habitat has not been designated for this species because the species could be overcollected for scientific purposes and because it does have potential for use as an ornamental.

### Description

Peperomia wheeleri, of the family Piperaceae (pepper family), was first discovered by Britton and Wheeler during their trip to Culebra in 1906. Plants were transported live to the New York Botanical Garden where the type specimen was collected and the species described. Only these collections and those made during a status survey (Vivaldi and Woodbury 1981) are known to exist.

Peperomia wheeleri is an evergreen, glabrous, erect herb which may reach 1 meter in height. The stems root only at the base and may be up to 1 centimeter in diameter. The opposite leaves are entire, fleshy, elliptic to elliptic-obovate, with 3 or 5 main veins ascending from the base. They may be 5 to 7 centimeters long and 2 to 3 centimeters wide with the base tapered to a 1 centimeter petiole. The lower side of the leaf is inconspicuously black punctate. Inflorescences are spikes, 10 to 16 centimeters long and 5 millimeters in diameter, which are borne solitary and opposite the leaves or at the leaf axils. Flowers are minute, approximately .5 millimeter in diameter.

### Distribution

Peperomia wheeleri is known only from Culebra, a small island approximately 27 kilometers to the east of Puerto Rico. The species has not been reported from adjacent small islands or the main island of Puerto Rico. On Culebra it is known only from the north slope semi-evergreen seasonal open forest where the species grows on granodiorite boulders. Elevations in this area range from 25 to 175 meters.

The available information indicates that the original collections made by Britton and Wheeler in the early 1900's were from Signal Hill. Destruction of forests in this area probably eliminated the species.

### Population Status

As indicated above, Peperomia wheeleri is restricted to the island of Culebra (Figure 1). The known site can be described as follows:

Monte Resaca, Culebra - On the northern slopes of this hill is a dense and well developed population. Several hundred plants may be present in an area of approximately .5 acre (.2 hectare), and many more are scattered throughout a larger area. The majority of this site lies within the Culebra National Wildlife Refuge. Seedlings have been observed to be numerous.

### Reproductive Status

Flowers of Wheeler's peperomia (Peperomia wheeleri) are bisexual. Pollination may be carried out by insects or wind, although the pollination biology of this species has not been studied. Many individuals have been observed flowering or in fruit and numerous seedlings are scattered throughout the area (Vivaldi and Woodbury 1981, U.S. Fish and Wildlife Service 1987).

Little is known about natural reproduction, however, individuals growing at Fairchild Tropical Garden (Garden) in Miami, Florida, flowered from June through August in 1989. Seed collected from this flowering began germination after 34 days; germination rate in this initial trial was less than 10 percent. Branches which have broken off and fallen to the ground in the Garden also root easily where they have fallen on humus (Lippincott pers. comm.). Cuttings root easily and many individuals are currently growing at the Garden.

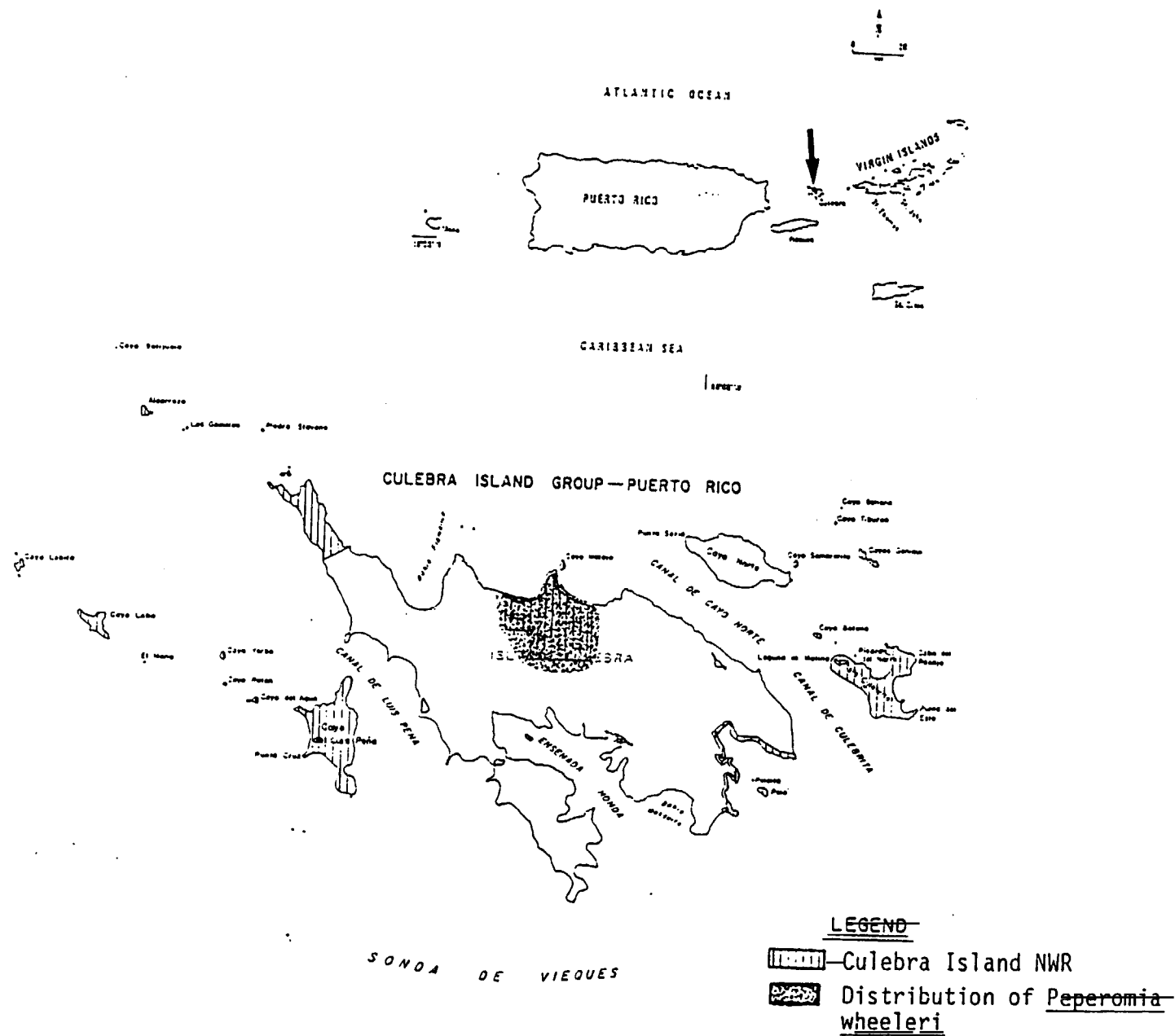


Figure 1. Present distribution of Peperomia wheeleri. Location of Culebra Island indicated in upper right corner.

Following Hurricane Hugo's devastating attack on Culebra in 1989, 25 cuttings were collected by the Refuge Manager at Culebra National Wildlife Refuge (NWR) from the Monte Resaca area. These were planted at the Department of Sports and Recreation nursery in Vega Alta, Puerto Rico and rooted quickly. The forest of the Monte Resaca area was defoliated by the hurricane but cover returned quickly, and the Peperomia wheeleri population suffered limited damage.

### Habitat Description

Culebra and the surrounding islands comprise an area of only 7,700 acres (3,116 hectares). Topography is irregular, the highest elevation is that of Monte Resaca (650 feet; 200 meters). Culebra and those cays adjacent to it are underlain by volcanic and intrusive rocks which are upper Cretaceous in age. Andesitic lava underlies most of the island and on the north coast it is overlain by andesitic tuff. In north central Culebra this tuff and lava have been intruded by diorite. This diorite has weathered to round boulders which may reach several feet in diameter. Between these boulders the soil is shallow and mixed with loose stones. Slopes in these areas are often greater than 60 percent (Department of Natural Resources 1976).

Mean minimum annual temperature is approximately 23.5 Celsius and mean maximum 34 Celsius. Mean annual precipitation is 44 inches (975 millimeters). Approximately 50 percent of the rainfall is received between August and November (Department of Natural Resources 1976).

Ewel and Whitmore (1973) classified the vegetation of the island of Culebra as belonging to the subtropical dry forest life zone, however, Peperomia wheeleri is found in a more mesic environment, the semi-evergreen seasonal forest. Only two strata are present, the tree canopy and the herbaceous layer. The canopy reaches 16 feet (5 meters) in height. Mature trees are 7 to 15 feet apart (3 to 5 meters), separated by large granodiorite boulders. Roots form an entangled mass. Species found in the canopy include Clusea rosea, Bursera simaruba, and Ficus citrifolia. In addition to Peperomia wheeleri, several species of Tillandsia, Anthurium acaule, Whittmackia lingulata, and Epidendrum cochleatum are found in the herbaceous strata.

Peperomia wheeleri is a component of the understory of this semi-evergreen seasonal forest. This small herb grows on the humus which accumulates on these granodiorite boulders. Removal of the forest canopy alters the microclimatic

conditions within this forest, resulting in the elimination of the humus substrate necessary for the survival of the species.

#### Known and Suspected Limiting Factors

Historically, Peperomia wheeleri was probably found throughout the understory of this type of open semi-evergreen seasonal forest in this part of Culebra. The species has not been reported from other small islands in the area or from Puerto Rico. Deforestation has eliminated the species from one previously known site, Signal Hill. Granodiorite boulders remain in some small forest remnants but these areas, as a result of extensive deforestation in surrounding areas and the creation of a more xeric environment, do not support the humus found in the rock forest on the north slopes of Monte Resaca.

Foraging by domestic fowl has been documented as impacting the species in all areas in which it is found. This results in destruction of the humus substrate which is essential to the reproduction and growth of Peperomia wheeleri.

#### Threats to Future Existence

Populations of Peperomia wheeleri, although protected as part of the Culebra National Wildlife Refuge, continue to face the threat of foraging by escaped domestic fowl and the possibility of impacts from erosion by cattle passing through the area. Forest cover is essential for healthy plants and continued reproduction. Any disturbance in this area could result in the loss of these plants.

Collecting has not been documented as a factor in the continued decline of Peperomia wheeleri. However, the number of remaining plants is small enough that taking of the species for any purpose could become a threat in the future, particularly if horticultural interest in the species develops (see below).

#### Cultivation Potential

Although there is no documentation that Peperomia wheeleri has been taken for horticultural purposes, many species in the genus Peperomia have been used as ornamentals. Therefore, the possibility exists that the species may be

recognized as having ornamental value. The ease with which Peperomia wheeleri roots from cuttings and the ability to produce viable seed in cultivation indicate that Fairchild's collection is a viable source of material for reintroduction of this species (Lippincott pers. comm.). It is not known if introduction of cultivated individuals will be successful.

#### Conservation Measures

Ongoing conservation/recovery efforts include propagation by both local (Puerto Rico Department of Sports and Recreation in cooperation with the Caribbean Field Office and Culebra National Wildlife Refuge) and off-island (Fairchild Tropical Garden) nurseries. Local efforts were begun as a response to the extensive damage to the forest following Hurricane Hugo. Monitoring during the post hurricane period has indicated that the population, despite some mortality as a result of exposure, appears to be recovering.

## PART II. RECOVERY

### A. Recovery Objective

The objective of this recovery plan is to provide guidance for reversing the decline of Peperomia wheeleri and restoring the species to a stable, secure, and self-sustaining status, thereby permitting it to be reclassified from endangered to threatened, and perhaps eventually allowing its removal from the Federal Endangered Species list.

Peperomia wheeleri can be considered for reclassification to a threatened species when the existing population is adequately protected and two additional populations are established within the Culebra National Wildlife Refuge or on other protected areas in Culebra. These should be considered minimum requirements, and should be expanded upon if the regenerative or propagative potential of natural and ex situ populations proves to be insufficient. If new populations are discovered, it may be preferable to place greater emphasis on protection rather than propagation.

## B. Narrative Outline

1. Prevent further habitat loss and population decline. Protection of habitat and individual plants at the known population site must be continued by public agencies and private organizations in order to prevent the complete extinction of the species, maintain genetic diversity, and provide a source of propagative material.
  11. Habitat protection. The protection of existing populations must be given the highest priority.
    111. Exclusion of domestic animals. Continue exclusion of domestic fowl and cattle from the areas of known populations of Peperomia wheeleri. Foraging by domestic fowl and trampling by cattle eliminates the microclimatic conditions necessary for successful growth and reproduction of the species.
  12. Plant protection. Individual plants and recruitment of new individuals must be monitored on a long-term basis.
    121. Monitor known populations. Individual plants should be measured and marked. Basic field observations which will contribute to the information available on population behavior include phenology, seed production, seed dispersal, recruitment success, site changes, and growth. These should be made at regular intervals. Plots should be established and efforts made to make this monitoring program long-term. This may be incorporated as part of the Culebra NWR work plan.
    122. Enforce existing Commonwealth and Federal endangered species regulations which prohibit taking. Federal endangered species regulations prohibit taking of plants on Federal lands. The majority of this population occurs on lands which are part of the Culebra NWR.
    123. Educate the public on plant conservation values and regulations pertaining to endangered species. Both Federal and Commonwealth agencies should become

involved in the education of the public on general conservation values as well as on the importance of protecting endangered plants and the laws involved in this. An initial step might be the preparation of a illustrated brochure and the preparation of a slide presentation (in Spanish) on endangered plants and plant communities for presentation to local school groups and organizations. This might be combined with a general presentation on all endangered species. Permitting and funding agencies should be made aware of endangered plants, the laws involved, and their responsibilities.

2. Continue to gather information on the distribution and abundance of Peperomia wheeleri. Additional information concerning the distribution and abundance of the species will affect future management decisions and the establishment of recovery priorities.
21. Continue to search for new populations.  
The search for new populations on Culebra should be continued.
  211. Identify and inventory potential sites.  
Based on a characterization of both habitat types and on an evaluation of forests which have not been thoroughly surveyed, potential population sites should be identified and searched. Coordinating agencies and organizations in this effort might be the U.S. Fish and Wildlife Service, the Forest Service Area of the Puerto Rico Department of Natural Resources, the Puerto Rico Natural Heritage Program, local universities and private conservation organizations.
  212. Characterize sites to determine their suitability for future recovery actions.  
If new populations are discovered, this information should be added to the data base of the various agencies and organizations involved, and, in addition, the sites should be evaluated for propagative material and their potential for protection. On sites identified as potential habitat but where no plants are

found, the suitability of the site for introduction of individuals should be determined.

3. Research. Little basic biological information is currently available on Peperomia wheeleri. Studies should focus on aspects of the population dynamics of life stages which may be critical in the recovery of the species.
  31. Define habitat requirements. Habitat requirements may be more clearly defined by evaluating existing site information and from studies of similar sites.
  32. Determine reproductive biology and ecology of Peperomia wheeleri. Fairchild Tropical Garden has initiated studies of the reproductive biology of this species at the Garden. Additional funding would enable staff to better develop these studies. Little information is currently available concerning the reproductive biology of this species in its natural habitat. Effective management and recovery depends upon obtaining this information.
    321. Assess periodicity of flowering and pollination mechanisms. Studies at the Garden indicate that in vitro flowering occurs during the summer months, June through August. The frequency, timing, and abundance of flowering, and the physical and biological factors controlling them in the species' natural environment should be determined as well. In addition, the species' pollination mechanisms should be identified, and consideration given to the requirements for successful pollination in the development of management plans.
    322. Assess seed production and dispersal. The quantity of seed produced and its ultimate fate should be assessed. Agents of seed predation and/or dispersal should be identified.

323. Evaluate seed viability and germination requirements. Evaluate the proportion of viable seed produced and the environmental conditions required for germination. Preliminary studies indicate that the germination rate is low. This should include both laboratory and field germination experiments.
324. Evaluate seedling establishment and growth. Conduct field experiments in conjunction with 323. above to determine suitable microsite conditions for seedling establishment and factors affecting seedling survival, the most critical stage in recruitment.
325. Evaluate role of vegetative regeneration. Determine what role, if any, vegetative regeneration plays in population dynamics. As indicated by nurseries, this species is easily propagated from cuttings.
33. Evaluate feasibility of artificial propagation. Continue ongoing work on artificial propagation from both cuttings and seed. Develop an artificial propagation program with local botanical gardens.
331. Assess relative feasibility of propagation from seed versus cuttings. Based on the availability of propagative material, economic and logistical considerations, and field success, determine the most feasible methods of propagation and transplantation to existing or new sites.
332. Determine feasibility of ex situ production of seed and/or cuttings. Determine whether there is sufficient material in ex situ cultivation to provide an alternative source of propagative material for use in the field.
34. Select appropriate sites for population introduction or enhancement using artificially propagated material. The success and ecological relevance of planting or transplanting propagative material depend upon adequate consideration of geography and habitat.

- 341. Assess habitat suitability. Using information from task 31 above, inventory potential sites to determine their suitability for supporting new or additional plantings of Peperomia wheeleri. Forest cover and availability of humus substrate have already been identified as essential to colonization.
- 342. Assure site protection. In addition to a suitable biological environment, the feasibility of site protection must also be considered.
  - 3421. Proceed with designation of appropriate protective status. If potential introduction sites proposed are not already on protected land, steps must be taken to alter the status of such land to provide protection for new species' populations.
  - 3422. Develop management plans for new sites. In accordance with the guidelines established in 111. and 112. above, develop appropriate plans for management of new sites. If the site is already within an existing management area, plans should be modified to consider the presence and needs of this species.
- 4. Refine recovery goals. As additional information on the biology, ecology, propagation, and management of Peperomia wheeleri is gathered, it will be necessary to better define, and possibly modify, recovery goals.
  - 41. Determine number of individuals and populations necessary to ensure species' stability, security, and self-perpetuation. Environmental and reproductive studies, together with the relative success of population protection measures, will allow more precise and realistic recovery goals to be established.

42. Determine what additional actions, if any, are necessary to achieve recovery objectives. If there are any actions not included in this recovery plan which, during the recovery process become recognized species' needs, they must be incorporated into the plan.

### C. Literature Cited and References

- Department of Natural Resources. 1976. The Culebra Segment of the Puerto Rico Coastal Zone Management Program. Commonwealth of Puerto Rico.
- Ewel, J. S. and J. L. Whitmore. 1973. Ecological life zones of Puerto Rico and the U.S. Virgin Islands. USDA - Forest Serv. Res. Paper ITF-18. 72 pp.
- U.S. Fish and Wildlife Service. 1987. Memorandum concerning the status of Peperomia wheeleri.
- U.S. Fish and Wildlife Service. 1987. Endangered and threatened wildlife and plants; proposed endangered status for Peperomia wheeleri. Federal Register 51(69): 12457-12460.
- Vivaldi, J. L. and R. O. Woodbury. 1981. Status report on Peperomia wheeleri. Status report submitted to the U.S. Fish and Wildlife Service, Mayaguez, P. R. 35 pp.

### PART III. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program. It is a guide for meeting the objectives discussed in Part II of this Plan. This schedule indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should bring about the recovery of the species and protect its habitat. It should be noted that the estimated monetary needs for all parties involved in recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species.

Priorities in Column 4 of the following Implementation Schedule are assigned as follows:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

## GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULE

### Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

### Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

### Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

### Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

# IMPLEMENTATION SCHEDULE

Peperomia wheeleri - Recovery Priority # 5

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					FWS	Other		FY 1	FY 2	FY 3	
					Region	Program					
M-3,4	Continue exclusion of domestic fowl and cattle from the areas of known populations of <u>Peperomia wheeleri</u>	111	1	Cont.	4	SE CINWR		1K	1K	1K	
I-1 M-3	Monitor known populations	121	1	Cont.	4	SE CINWR	PRDNR	1K	1K	1K	
O-2,3	Enforce existing Commonwealth endangered species regulations	122	1	Cont.	4	SE CINWR	PRDNR	.5K	.5K	.5K	
O-1	Educate public on plant conservation and regulations	123	2	Cont.	4	SE CINWR	PRDNR Univ.	.5K	.5K	.5K	
I-1,2	Identify and inventory potential sites	211	2	2-4 yrs.	4	SE	PRDNR Univ.	1K	1K	1K	(includes 211 and 212)
I-1,2	Characterize sites to determine their suitability for future recovery actions	212	2	2-4 yrs.	4	SE	PRDNR				
R-3	Define habitat requirements	31	2	2-4 yrs.	4	SE CINWR	PRDNR Univ.	3K	3K	3K	

# IMPLEMENTATION SCHEDULE

## Peperomia wheeleri

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimated Fiscal Year Costs			Comments/Notes
					Region	Program	Other	FY 1	FY 2	FY 3	
R-6,14	Assess periodicity of flowering & pollination mechanisms	321	2	2-4 yrs.	4	SE	PRDNR Univ. BotGar.	5K	5K	5K	(including 321, 322, 323, 324, and 325)
R-6,14	Assess seed production & dispersal	322	2	2-4 yrs.	4	SE	PRDNR Univ.				
R-6,14	Evaluate seed viability and germination requirements	323	2	2-4 yrs.	4	SE	PRDNR Univ.				
R-6,14	Evaluate seedling establishment & germination requirements	324	2	2-4 yrs.	4	SE	PRDNR Univ.				
R-6,14	Evaluate role of vegetative regeneration	325	2	2-4 yrs.	4	SE	PRDNR Univ. BotGar.				(includes 211 and 212)
R-7 M-1,2	Evaluate relative feasibility of propagation from seed vs. cuttings	331	2	2-4 yrs.	4	SE	PRDNR Univ. BotGar.	1K	1K	1K	(includes 331, and 332)
M-1	Determine feasibility of <u>ex situ</u> production of seed and cuttings	332	2	2-4 yrs.	4	SE	Univ. BotGar.				

# IMPLEMENTATION SCHEDULE

## Peperomia wheeleri

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency			Estimate Fiscal Year Costs			Comments/Notes
					FWS		Other	FY 1	FY 2	FY 3	
I-2 M2,3	Assess habitat suitability	341	2	Cont.	4	SE	PRDNR Univ.	1K	1K	1K	
M-2 A-2,3,6	Assess site protection	342	2	Cont.	4	SE	PRDNR				
I-1 R-6	Determine number of populations & individuals necessary to ensure species' self-perpetuation	41	2	Cont.	4	SE	Univ.				
I-4	Determine what additional actions are necessary to achieve recovery goals	42	2	Cont.	4	SE CINWR	PRDNR				

## LIST OF ABBREVIATIONS

BotGar. - Botanical Gardens  
 PRDNR - Puerto Rico Department of Natural Resources  
 SE - Endangered Species Program, FWS  
 CINWR - Caribbean Islands National Wildlife Refuge, FWS  
 Univ. - Universities

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